SYNOPSIS ON

Investigation on groundnut stem rot and pod rot incited by *Sclerotium rolfsii* Sacc.

SUBMITTED TO

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY NANDED

For the award of

Doctor of Philosophy (Ph.D.)

in Botany

Faculty of Science and Technology

BY

Mr. Pramod Ramchandra Bhandarge

Under guidance of

DR. MUKUNDRAJ B. PATIL
Head, Department of Botany
Late Ramesh Warpudkar College, Sonpeth.

Research Centre

Department of Botany
Dnyanopasak Shikshan Mandal's College of Arts Commerce and Science, Parbhani

Introduction

Groundnut (*Arachis hypogaea* L.), is one of the most popular oil seed crops grown throughout the world. It is considered as "King of oilseed crops", because it contains 40 to 49 per cent oil. It is self-pollinated crop having chromosome no. 2n=4X=40.

Groundnut belongs to family *Leguminaceae*, is a tropical crop requiring long and warm growing season. The favourable climate for groundnut is a well distributed rainfall of at least 50 centimeters during the growing season, abundance of sunshine and relatively warm temperature.

Groundnut is believed to be the native of Brazil shifted to Peru, Argentina and Ghana, from where it was introduced into Jamaica, Cuba and other West Indies islands. The plant was introduced by Portuguese into Africa from where it was introduced into North America. It was introduced into India during the first half of the sixteenth century from one of the Pacific islands of China, where it was introduced earlier from either Central America or South America (Jasani, 2009).

The groundnut is particularly valued for its protein content (26%). On equal weight basis, groundnut contains more protein than meat and about two and half times more than eggs. In addition to protein, groundnut is a good source of the minerals *viz*., calcium, phosphorus, iron, zinc and boron. The groundnut also contains vitamin E and small amounts of vitamin B complex. It is high in calories, 5.6 calories nut -1 (calorific value of 567). It's food value is: Proteins (25.2%), Oil (48.2%), Starch (11.55), soluble sugar (4.5%) and moisture (6%).

The area, production and productivity of groundnut has been reported to be 20.84 and 5.00 million hectares, 37.20 and 5.00 million metric tons and 1.79 and 1.00 metric tons per hectare, respectively in the World and India (Anonymous, 2013). The major groundnut-producing countries of the world are: India, China, Nigeria, Senegal, Sudan, Burma and USA. Major groundnut growing states in India are: Gujarat, Andhra Pradesh, Tamil Nadu and Karnataka. The total area in Maharashtra under groundnut was 0.357 million hectares, production of 0.458 million metric tons and productivity of 1.28 metric tons per hectare (Anonymous, 2012).

Groundnut is affected by several plant pathogens including fungi, bacteria, viruses and nematodes. The major fungal diseases are : Early leaf spot (*Cercospora*

arachidicola Hori), Late leaf spot (*Phaeoisariopsis personata* (Berk. & Curt.) v. Arx, Rust (*Puccinia arachidis* Speg.), Aflaroot / aflatoxins (*Aspergillus flavus* Link ex Fr.). Crown / Pod rot (*Aspergillus niger* van Tiegh), Stem and pod rot (*Sclerotium rolfsii* (Sacc.), Phyllosticta leaf spot (*Phyllosticta* sp.), Leaf blight (*Phomopsis* sp.), Wilt (*Fusarium oxysporum* Schlecht emend Synd. & Hans.), Dry root rot /Dry wilt (*Macrophomina phaseolina* and *Rhizoctonia bataticola*), Alternaria leaf spot (*Alternaria arachidis* and *A. tenuissima*), Anthracnose (*Colletotrichum dematium* and *C. capsici*), Rhizopus and seedling rot (*Rhizopus arrhizus*, *R. oryzae* and *R. stolonifer*); bacterial disease : Wilt (*Pseudomonas solanocearum* E. F. Smith); Viral diseases: Groundnut rosette (Groundnut rosette viruses), Peanut mottle (Peanut mottle virus), Streak necrosis (Sunflower yellow blotch virus), Mild mottle (Cowpea Mild mottle virus), Bud necrosis (Tomato spotted wilt virus), Peanut clump (Peanut clump Virus) and Nematode disease, Root- knot nematode (*Meloidogyne arenaria, M. halpa* and *M. javanica*) (Kannaiyan, 1989).

Stem rot and pod rots of groundnut caused by *Sclerotium rolfsii* Sacc. is major constraints in groundnut production in many countries in Asia, Africa and the Americas. The fungus also causes the disease *viz*., collar rot, southern blight, southern stem rot, sclerotium rot, or white mold, in many agronomical and horticultural crops. The first confirmed report of losses due to *S. rolfsii* was made by Rolfs in 1892 on tomato (*Lycopersicon esculentum* Miller) in Florida (Aycock, 1966). But, in India, Shaw and Ajrekar (1915) isolated the fungus from rotted potatoes and identified as *Rhizoctonia destruens* Tassi. However, later studies showed that the fungus involved was *S. rolfsii* (Ramkrishnan, 1930). The name *Sclerotium rolfsii* was given by Saccardo (1911), who characterized the fungus as an imperfect form without asexual spore. The basidial stage was subsequently known from culture only and was assigned the name *Corticium rolfsii* (Sacc.) Curzi, later changed to *Pellicularia rolfsii* (Sacc.) West (West, 1947). Tu Kimbrought (1978) gave the specific epithet as *Athelia rolfsii* (Curzi) Tu and Kimbrought.

Sclerotium rolfsii Sacc., an omnivorous and devasting soil borne fungal plant pathogen. The pathogen has a wide host range of over 500 plant species in 100 families, throughout the world (Ferreira and Boley, 1992), mostly infecting legumes, crucifers and cucurbit. The diseases caused by the fungus are more serious in tropical and sub-tropical regions. The large number of sclerotia produced by *S. rolfsii* and their ability to persist in the soil for several years, as well as the profuse growth rate of the fungus make it well suited facultative parasite and a pathogen of major importance throughout world (Punja, 1985).

In India, stem rot is of common occurrence in all groundnut growing states; it is most sever in Maharashtra, Gujarat, Madhya Pradesh, Orisa and Tamil Nadu, where it infected over 500 000 ha of groundnut fields. The yield losses in the range of 10-50 per cent due to stem and pod rot caused by *Sclerotium rolfsii* (*Corticium rolfsii*) in groundnut were reported (Chohan, 1974; Mayee and Datar, 1988; Mehan and McDonald, 1990; Mehan *et al.*, 1995; Dandnaik, 2006; Rakholia *et al.*, 2012).

The most prominent initial symptoms produced by *Sclerotium rolfsii* on groundnut are: yellowing and wilting of the lateral branches or wilting of the whole plant, leaves on affected branches became chlorotic, turn brown and rapidly dry out. Abundant whitish cottony mycelial growth was found around the affected plants at or near the soil surface (collar region), imparting 'white –washed' appearance to the base of the affected plants. Lesions developed on infected stem were initially light brown which later turned dark brown, coalesced and caused girdling of the main stem at collar region. With advancement of the disease, the affected stem starts shredding which is the indication of stem rot. The sheathing mycelium quickly produce abundant spherical *sclerotia* on the surface of the affected stem or on the soil surface adjacent to affected plants.

Review of Literature

Pod rot diseases are widespread in the SAT and are known to cause severe damage in a number of countries (Abdou and Khadr 1974; Frank1972; Mercer 1977; Porter *et al*. 1975). High levels of pod rot were observed in the 1978-79postrainy season crop at ICRISAT and screening of germplasm for resistance was initiated. Some 2000 genotypes have now been screened under natural field disease conditions. Stan-dard local cultivars had 20-25% of pods rotted while disease levels in germplasm lines ranged from 4 to 72%.

Anahosur and Kulkarni (1997) conducted a roving survey in 1997 on wilt of potato caused by *Sclerotium rolfsii* and reported its maximum incidence in Puddalakatti (40%), followed by Tadakod (20%) in Dharwad district and Bastewad (40%) in Belgaum district.

Marinelli *et al*. (1998) reported that yield losses in groundnut caused by soil borne fungi *viz., Sclerotinia minor, S. sclerotiorum and Sclerotium rolfsii* were ranged from 30 to 870 kg/ha.

Hanumanthegowda (1999) carried out survey on stem rot of groundnut during *Kharif* 1998-99 and *Rabi /* summer 1998-99 in Dharwad, Belgaum and Haveri districts. He reported a maximum disease incidence of 12.57 and 8.68 per cent in rainfed and irrigated fields, respectively.

Thiribhuvanamala *et al*. (1999) reported that in tomato the disease collar rot (*S. rolfsii*) caused about more than 30 per cent yield losses.

Naidu (2000) reported that crossandra as a new host for *S.rolfsii,* which caused 40-50 per cent mortality in crossandra in Chittoor district of Andhra Pradesh.

Adiver and Anahosur (2002) conducted the survey of groundnut growing 5 districts of Karnataka state during *Rabi / Summer* of 1992-93, 1993-94 and 1994-95 at the pod maturity stage and reported that highest incidence of pod rot (100%) at Rajur (Dist. Raichur), followed by Gajendragad (Dist. Raichur) with 97.90 per cent and Anatasyanangudi (Bellery) with 96.30 per cent disease incidence. They also reported that pod rot of groundnut was caused by 6 fungi of which *A. flavus* (Kernel : 90 %and Shell : 0.83%), *Fusarium oxysporum* (Kernel :10.83% and Shell :26.00%) and *F. solani* (Kernel : 1.70% and Shell :

29.25%) were predominant and least pod rot was caused with the fungi *Rhizoctonia solani* (Kernal:2.20% and Shell : 2.92%) and *Sclerotium rolfsii* (Kernel : 0.40%).

Ansari (2002) reported that southern blight of soybean caused by *Sclerotium rolfsii* caused upto 65 per cent yield lossess under severe epiphytotics of the disease in Indore, Madhya Pradesh.

Dandnaik *et al*. (2006) reported that stem rot of groundnut caused by *Sclerotium rolfsii* caused over 35 per cent yield lossess.

Kadam *et al*. (2011) conducted the survey of groundnut fields (47 locations) in Latur and Beed districts of Marathwada region during August – September 2003, to record the incidence of collar rot (*S. rolfsii*) of groundnut on different varieties. They reported maximum average disease incidence (17.8%) in Renapur Tahsil, followed by Udgir (16.7%), Ausa (14.7%), Latur (14.3) and Nilanga (8.9%) Tahsils. Among the five groundnut varieties, maximum average disease incidence was noticed on JL-24 (collar rot : 15.3, stem rot:6.2%) followed by Local (collar rot : 14.9, stem rot : 5.8%), TG-26 (collar rot : 14.2, stem rot : 5.2%), LGN-1 (collar rot : 13.7, stem rot : 4.9%) and SB XI (collar rot : 10.9, stem rot : 4.3%).

Rakholia *et al*. (2012) reported that stem rot of groundnut caused by *Sclerotium rolfsii* caused 28-50 per cent yield losses.

Somani and Chauhan (1996) observed a thin white mycelial mat on the surface of freshly harvested potato tubers and also thick mat with mustard seed like sclerotia. *Sclerotium rolfsii* infected plants had white to mustard coloured sclerotia, white mycelial mat on almost all the infected plant parts and daughter tubers and the plants wilted after tuber formation. They also observed wilt at early stage before tuberization.

Naidu (2000) described the collar rot symptoms on crossandra [*Crossandra infundibuliformis* (L.) Nees.] Incited by *S. rolfsii*. The infected plant showed shrunken and brown coloured bark first on the collar region that later spread to roots. When the bark was peeled off, the inner tissue showed brown to black discolouration. The roots of the affected plants were found rotten. Yellow to pink discolouration of leaves followed by shedding and ultimately leading to drying of plants was also reported.

Anasri *et al.* (2011) described the symptoms of collar rot disease of crossandra as shrunken and brown coloured bark which first appeared on the collar region and later

spreading to roots. When the bark was peeled off, the internal tissues revealed brown to black discolouration with rotten roots. Yellow to pink discolouration followed by shedding of leaves was observed leading to drying of plants.

Lahre *et al*. (2012) described symptoms of collar rot of chickpea caused by *S. rolfsii,* drying of plants with foliage turned slightly yellow before death, scattered throught the field as an indication of collar rot infection.

Chattannavar and Hosagoudar (2011) studied morphological characters and virulence of 17 isolates of *Sclerotium rolfsii* Sacc. on *Bt* and non *Bt* cotton genotypes. They reported that growth rate of *S. rolfsii* isolates varied significantly at 6 DAI and isolates of U.A.S Dharwad 2 and Lokur were fast growing (each 8.85cm). Sclerotia production, size and colour also varied significantly.

Bainade *et al.* (2006) tested *in vitro* eleven culture media for physiological studies of *M. phaseolina* (blight of mungbean). They reported that highest mycelial growth (89.00 mm) and abundant sclerotial production (++++) was observed on mung leaf medum. This was followed by soybean seed medium [88.70 mm and fair : +++], PDA [78.70 mm and abundant ++++], Peptone dextrose [69.10 mm and Good : ++], Richard's media [66.90 mm and abundant : ++++] and Dextrose nitrate agar [48.86 mm and poor : +]. Least mean mycelial growth and sclerotial production were observed in Rice meal agar [39.20 mm and poor : +], Asthana and Hawker's [36.90 mm and good : ++], Maize meal agar [35.00 and Nil : -] and Kerr's media [0.00 mm and Nil : -].

Rajalakshmi *et al.* (2006) tested *in vitro* the effect of three solid media (Potato dextrose agar, Oat meal agar and Czapek's dox agar) on mycelial growth and sclerotial population, and six liquid media (Richard's, Coon's, Potato broth, Crossandra host extract, Groundnut host extract and Tomato host extract) for their effect on mycelial dry weight (mg) of *S. rolfsii,* causing stem and pod of groundnut. They reported that among solid media maximum mean mycelial growth (90.00 mm) and fair sclerotial population (++) were record with PDA, followed by Oat meal agar [88.00 mm and fair] and Czapek's dox agar [51.7mm and fair]. Among liquid media, maximum mycelial dry weight was recorded with Potato broth (444.7mg), followed by Groundnut host extract (367.7 mg), Richards agar (341.1 mg) and minimum mycelial dry weight was recorded with Crossandra host extract (204.0 mg) , followed by Tomato host extract (120.7 mg) and Coon's agar (85.mg).

Jha *et al.* (2007) evaluated *in vitro* four oil cakes (Castor, Neem, Mustard and Groundnut) and saw dust extracts against *Sclerotinia sclerotiorum*, causing white mold of *Phaseolus vulgaris.* They reported that maximum mycelial inhibition (48.88%) and no sclerotia with saw dust extract followed by the extracts of Castor cake (27.41%) and no sclerotia, Mustard cake (20.96%) and, 14.33 sclerotia / plate and 275 mg sclerotial weight / plate, Neem cake (18.15 %) with no sclerotia and minimum percent mycelial inhibition (1.40%), maximum number of sclerotia (21 / plate) and maximum weight of sclerotia (460 mg / plate) with Groundnut cake.

Tomar (2007) evaluated the efficacy of organic soil amendments against root rot (*Fusarium solani*) of *Acacia catechu*. They reported that Neem cake was most effective with significantly least root rot incidence (21.67%), followed by Cotton seed cake (23.33%), Sunflower cake (30.14%), Mustard cake (43.55%) and FYM (45.23%).

Muthukumar (2009) evaluated *in vitro* (@ 10 %) and pot culture (each @ 8g/pot) the seven oil cakes (Neem, Coconut, Sesame, Pungum, Illupai, Cotton and Groundnut) against *Fusarium oxysporum* f. sp. *polyanthi,* causing tuber rot of tuberose. They reported that minimum mean mycelial growth (29.00 mm), maximum germination (94.0%) and minimum disease incidence (32.6%) with Neem cake, followed by Illupai (34.0mm, 92% and 38.6%) and Pungam cake (37.0 mm, 87% and 47.5%). Maximum mean mycelial growth (54.0mm), minimum germination (54%) and maximum disease incidence (82.00%) were observed with Cotton cake, followed by Groundnut cake (49mm, 69% and 72%) and sesame cake (47mm, 75% and 63.7%).

Mehta *et al.* (2010) evaluated *in vitro* (Pot culture) seven organic amendments (@ 20gm/kg soil) against *Sclerotinia sclerotiorum,* causing white stem rot of mustard. They reported that minimum mortality was observed with Mustard cake (4.1%), followed by Sesame cake (4.8%) and seed powder of *S. cuminii* (7.8%). Maximum mortality was observed with FYM (23.4%) and Poultry manure (24.1%); whereas, minimum per cent disease intensity was recorded with Poultry manure (29.9%), followed by Neem seed powder (30.0%) and Cotton cake (31.7%) and it was maximum with FYM (41.7%) and Mustard cake (45.8%).

Chandel (2011) evaluated (pot culture) six organic materials *viz.*, Poultry manure, Pine needle, Mustard oil cake, Castor oil cake, Neem cake and Wheat cake (@ each 2 % ; w/w) against *Fusarium* wilt of carnation. They reported maximum disease control with Pine

needle (70.0%), followed by Mustard oil cake (50.2%); whereas, it was minimum with Poultry manure (13.6%), followed by Wheat straw (29.0%) and Neem cake (29.9%).

Gap of Research area:

- As per literature survey only the least article is published is ‘ground rot and pod rot diseases from marathwada region parbhani, District, Maharashtra (India).
- Huge losses due groundnut rot and pod rot in given area or research area.
- It is also observed that, to this date, no article has been published on any of the aspects including effect of different media on causal organism and their management in Marathwada region, parbhani district.

Statement of the problem:

Stem rot and pod rot of groundnut caused by Sclerotium rolfsii Sacc. is one of the major constraint to groundnut production in many countries. The fungus is ubiquitous, soil inhabitant and non-target. Screening of groundnut genotypes for resistance to stem rot under field conditions is complicated by the non-uniform spatial distribution of the pathogen. While development and maintenance of artificial sick plot with optimum inoculums load under field conditions are also difficult because of sensitivity of the pathogen to temperature, humidity, soil type, cropping system and host preference. In the present study, a screening technique under field conditions with high disease pressure has been reported.

Scope of Research work:

The groundnut cultivation is often subjected to significant yield losses annually due to biotic and abiotic stresses and are the major limiting factors for attaining high productivity in India. Among various biotic stresses, soil borne and foliar diseases account for reduced pod yields (Vineela *et al*., 2018). Stem rot (*Sclerotium rolfsii* Sacc.) and pod rot of groundnut are causing major havoc in all crop growing areas (Jadon *et al*., 2015). Among these, collar rot and stem rot diseases are the major soil borne diseases with significant yield losses annually. So, present work focus on study of stem rot and pod rot of groundnut from parbhani district Maharashtra India and develop strategies of acute diagnosis and minimise yield loss as well as helps to further investigation for plant pathologist.

Relevance of Research work:

Sclerotium rolfsii is difficult to control due to its wide host range of over 500 plant species. The low productivity in groundnut is attributed to many production constraints. Among these, biotic factors, particularly diseases play a major role in limiting the yield of groundnut. It is most affected with the pathogen Sclerotium rolfsii sac, which is a soil-borne pathogen and causes disease in different crops including peanut. Biological control is an alternate source by introducing soil borne pathogens, which helps in suppressing the disease. While in combination with bio control agents and fungicides for seed treatment, it was effective in suppressing the pathogen, besides reducing the environmental hazards and cost of cultivation. This paper reviews the literature on Sclerotium rolfsii, inducing stem rot disease and its management.

Significance of the work:

Stem and pod rot of groundnut caused by *Sclerotium rolfsii* Sacc. is an economically important disease of groundnut causing considerable economic loss to the crop grown under rainfed as well as irrigated conditions in Maharashtra . Yield losses usually range from 10 to 25% in India, Thailand, Indonesia, Taiwan, and the Philippines but may reach 80% in severely infested fields (Mayee and Datar 1988). About 20-60% of pod yield reduction was observed due to pod rot in widely cultivated varieties. Present work are selected in area parbhani district (MS) india.

Aims and objectives

1. To survey groundnut fields for recording stem rot and pod rot (*Sclerotium rolfsii*) incidence during *Kharif* and *Rabi* seasons in Marathwada region.
2. To isolate, identify and cultural and morphological characterization of *S. rolfsii* isolates collected during survey.
3. To prove pathogenicity of the selected isolates of *S. rolfsii.*
4. To study the effect of different culture media on growth and sporulation of *S. rolfsii.*
5. Disease management strategies

    5.1. To evaluate the bioefficacy of fungicides against *S. rolfsii* (Poisoned food technique and Pot culture).

5.2. To evaluate the fungal and bacterial antagonists against *S. rolfsii* (Dual culture technique and Pot culture).

5.3. To evaluate the antifungal potential of higher plant extracts against *S. rolfsii* (Poisoned food technique and Pot culture).

5.4. To integrate the efficient fungicides, biocontrol agents, plant extracts and organic and inorganic amendments for management of *S. rolfsii* (Pot culture).

Hypothesis:

Stem and pod rot, also called southern blight, is a fungal disease that occurs wherever groundnuts are grown. It causes up to 10-25% reduction in pod yields worldwide. Losses in Africa are not well recorded but, as it is present in more than 45 countries, they are likely to be high. The fungus is soil-borne, attacking groundnut stems just below soil level and causing leaves to yellow and wilt. As the disease develops, the characteristic thick white cottony fungus grows above ground.

MATERIALS AND METHODS:

Experimental site

Laboratory (plate and pot culture) and field experiments will be conduct at the at DSM college, Parbhani district.

Disease samples

Stem and pods of groundnut exhibiting typical symptoms of stem rot and pod rot (*S. rolfsii*) disease were collectein the paper bags from the groundnut fields, survey in *Kharif* and *Rabi,*. The diseased samples will be brought to the laboratory and subjected aseptically to tissue isolation on Potato dextrose agar medium and other convenient media.

Symptoms, Disease incidence and severity analysis:

Survey and sampling of Marathwada region Aurangabad, locations was carried out following Masyahit *et al*.2009; Charles Awa Onyeani and N. Amusa, 2015 method. Disease incidence (percentage of diseased fruits) and disease severity (percentage of area affected on the fruit on average) was then obtained using the following formula:

$$\textbf{Disease incidence (DI)} = \frac{X}{N} x\ 100$$

where, X = Numbers of infected fruits and N = Total number of fruits and leaves sampled.

$$\textbf{Disease severity (DS)} = \frac{\sum(a+b)}{N} x \frac{100}{Z}$$

where, Σ (a + b) = Sum of symptomatic fruits and their corresponding score scale, N = Total number of fruits sampled and Z = Highest score scale. Five is the highest disease rating.

Isolation

Isolation of fungi from infected fruits and leaves will isolation on PDA (Potato Dextrose Agar) medium. Initially the fruit were surface sterilized with the solution of 0.1% $HgCl_2$. To remove the traces of HgCl2 the fruits were washed with distilled water for 3-4 times. Then a small piece of infected region of fruit was removed with the help of sterile needle and the piece was inoculated on PDA (Potato Dextrose Agar) medium amended petiriplates in sterile condition. The petiriplates were incubated at room temperature 25+- 1 C ^{0}, (Gadgile, *et, al*. 2010).).

Culture media

Potato Dextrose Agar (PDA) will be basal culture medium for isolation, purification and maintenance of the pure culture of *S. rolfsii*. Sand: maize (1:2) medium was used for mass multiplication of the pathogen. For studying cultural characteristics of *S. rolfsii* synthetic ready-made (make: Hi media) and non-synthetic (prepared) media were use.

Microscopic examination

Stem rot and pod rot diseased groundnut plant specimens brought to the laboratory were washed gently with distilled water to remove extraneous materials and blot dried. Whitish growth on stem and pods was gently picked up with the sterile needle, placed in a drop of Lactophenol on clean glass slide, covered with cover slip, mounted initially under low power objective lens of the compound microscope (make : Labomed Vision 2000) and observed the mycelium and colour of the mycelium.

Chemicals

Standard chemicals, reagents, fungicides, culture media etc

Glasswares

The common glass-wares (Borosil, J-sil and Corning make) *viz.,* Petri-dishes, test tubes, conical flasks, volumetric flasks, measuring cylinder, glass rods, beakers, funnel, pipette, etc

Equipments

The laboratory equipment's *viz.,* Autoclave, Hot air oven, Laminar airflow Cabinet, BOD Incubator, Refrigerator, Binocular Research Microscope, Electronic balance, pH meter, Refrigerator etc.

Biocontrol agents

Pure cultures and talk based formulations of biocontrol agents *viz., Trichoderma viride, T. harzianum, T. hamatum, T. longibrachiatum, T. koningii, Pseudomonas fluorescens* and *Bacillus subtilis*

Plant extracts / botanicals

Plant species reported to exhibit antifungal and therapeutic properties (Alice, 1984) against fungal pathogens and available locally.

Organic and inorganic amendments

Organic amendments *viz.*, Neem seed cake, Caster cake, Groundnut cake, Cotton seed cake, Sunflower cake, Safflower cake, Karanj cake, Farmyard manure / Compost, Poultry manure, Vermicompost and inorganic Gypsum.

Expected outcome:

The expected outcome of this research work includes identification of fungi cause serious diseases in groundnut in the area of parbhani this work help in acute diagnosis of fungal disease also strategies develop in research of plant pathology for further investigation of diseases as well as the management of groundnut fungal diseases by different plant based as well as chemical and biological.

Plan of work:-

First year

- Review of Literature, collection, study of references and methodology books.
  Servey carried of groundnut cultivation.
- Collection and Identification of specimens of infected groundnut diseases and disease incidence.
- Isolation and pure culture of fungi from groundnut.

Second year

- To study the effect of different culture media on growth and sporulation of *S. rolfsii*.
- To prove pathogenicity of the selected isolates of S. rolfsii.

Third year

- Disease management strategies.
- Data analysis, conference and research article publication etc.
- Writing and submission.

This work will be carried out in following parts:

Part-1: This part will deal with detailed information about collection,identification and stem and pod rot of groundnut from Parbhani district (MS).

Part-2: This part will deal with Screening of Isolation and pure culture of fungi from groundnut.

Part-3: This part will deal with the To study the effect of different culture media on growth and sporulation of *S. rolfsii*.

- **Part-4:** This part will deal with study of disease management strategies.
- Data analysis, conference and research article publication and writing and submission.

References

1) ABDOU, Y. A, and KHADR, A. S. 1974. Systemic controlof seedling and pod rot disease of peanut (Arachis hypogaea L). Plant Disease Reporter 58: 176-179.
2) Adiver, S.S. and Anahosur K.H. (1995). Efficacy of some triazole fungicides against late leaf spot of groundnut and their subsequent effects on *Sclerotium rolfsii*. Indian Phytopath. 48 (4): 459 - 462.
3) Anahosur, K.H. and Kulkarni, S. (1997). Survey of potato *Sclerotium* wilt in parts of Karnataka. Paper presented at Indian Phytopathological Society (SC) Meeting held at IIHR, Bangalore from 18-29 Dec. 1997.
4) Anonymous, (2012). Economic survey of Maharashtra 2011-12. https:// www. Maharashtra. gov. in.
5) Ansari, M.M. (2005). Growth, survival, perpetuation and pathogenic variability of *Sclerotium rolfsii*, a polyphagus pathogen- A review. J. Oilseed Res.: 22 (2): 240-244.
6) Aycock, R. (1966). Stem rot and other diseases caused by *S. rolfsii*. North Carolina Agricultural Experimental Station, Tech. Bull. 174 : 202.
7) Chohan, J.S. (1974). Recent advances in diseases of groundnut in India. In: Current Trend in Plant Pathology, Lucknow Univ. Press, Lucknow, Utter Pradesh :171-184
8) Dandnaik, B.P.; Dhoke, P.K. and Pensalwar, S.N. (2006). Integrated management of stem rot (*Sclerotium rolfsii*) in groundnut. J. Pl. Dis. Sci. 1 (2): 234-235.
9) Dandnaik, B.P.; Dhoke, P.K. and Pensalwar, S.N. (2006). Integrated management of stem rot (*Sclerotium rolfsii*) in groundnut. J. Pl. Dis. Sci. 1 (2): 234-235.
10) Ferreira, S.A. and Boley, A.R. (1992). *Sclerotium rolfsii*. Extension Plant Pathologist. Dept. Pl. Pathol., CTAHR. Univ. of Hawaii at Manoa.
11) FRANK, Z. R. 1972. Notes on soil management inrelation to Pythium rot of peanut pods. Plant DiseaseReporter 56: 600-601
12) Hanumanthegowda, B.; Adiver, S.S. and Girish, A.C. (2002).Integrated disease management of groundnut caused by *Sclerotium rolfsii* Sacc. J. Mycol. Pl. Pathol. 32 (3): 425.
13) Kadam, T.S.; Khalikar, P.V. and Nikam, P.S. (2011). Survey and surveillance of collar rot of groundnut caused by *Sclerotium rolfsii* in Marathwada region. J. Pl. Dis. Sci. Rakholia, K. B. and Jadeja, K. B. (2010). Varietial screening of groundnut against stem and pod rot (*Sclerotium rolfsii*). Int. J. Pl. Prot. 3(2):398-399.

14) Lahre S.K.; Khare N.; Lakpale, and Chaliganjewar S.B. (2012). Effect of bioagents and organic amendments against *Sclerotium rolfsii* in chickpea. J. Pl. Dis. Sci. 7 (1) : 32- 34.

15) Marinelli, A.; March, G.J.; Rago, A. and Giuggia, J (1998). Assesment of crop loss in peanut caused by *Sclerotinia sclerotiorum*, *S. minor* and *Sclerotium rolfsii* in Argentina. Int. J. Pest Manag. 44 :251-254.

16) MERCER, P. C. 1977. A pod rot of peanuts in Malawi.Plant Disease Reporter 61: 51-55.

17) Naidu H. (2000). Crossandra - a new host record for *Sclerotium rolfsii*. Indian Phytopath. 53: 496-497.

18) PORTER, D. M., GARREN, K. H., and VAN SCHAIK, P. H.1975. Pod breakdown resistance in peanuts. PeanutScience 2: 15-18.

19) Punja, Z.K. and Damiani, A., (1996). Comparative growth, morphology and physiology of *Sclerotium* species. Mycologia. 88: 674-706.

20) Rakholia K.B.; Jadeja K.B. and Parakhia A.M. (2012a). Management of collar rot of groundnut. J. Mycol. Pl. Pathol. 42 (1): 97.

21) Ramkrishnan, T.S. (1930). A wilt of Zinnia caused by *Sclerotium rolfsii*. Madras Agril. J. 16: 511-519.

22) Saccardo, P.A. (1911). Notae Mycological, Annals Mycologici, 9:249-257.

23) Shaw, F.J.P. and Ajrekar, S.L. (1915). The genus *Rhizoctonia* in India. Memoirs. Department of Agriculture in India. Botanical Series. 7: 177-194.

24) Somani, A.K. and Chauhan, R.K.S. (1996). Potato tuber rots in Gwalior, Madhya Pradesh. J. of the Indian Potato Asso. 23: 144-148.

25) Thiribhuvanamala, G.; Rajeswari, E. and Doraiswamy, S. (1999). Inoculum levels of *Sclerotium rolfsii* on the incidence of stem rot in tomato. Madras. Agril. J. 86 : 334.

26) Tu. C.C. and Kimbrough, J.W. (1978). Systematics and phylogeny of fungi in the Rhizoctonia complex. Bot. Gaz. 139: 454-466.

27) West, E. (1947). Sclerotium rolfsii Sacc. and its perfect stage on climbing fig. Phttopathology, 37: 67-69.

28) Vineela, D. R. S., Beura, S. K., Dhal, A. and Swain, S. K. (2018). Integrated management of soilborne diseases of groundnut in coastal ecosystem of Odisha. Journal of Mycopathological Research, 56(3): 189–193.

29) Jadon, K. S., Thirumalaisamy, P. P., Kumar, V., Koradia, V. G. and Padavi, R. D. (2015). Management of soil borne diseases of groundnut through seed dressing fungicides. Crop Protection, 78: 198–203.

Mr. Pramod Ramchandra Bhandarge **Dr. Mukundraj B. Patil**

(Research student) **(Research guide)**